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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/109,261 06/30/98 BAI

G 042390.P5769

EXAMINER

MMC1/0813

BLAKELY SOKOLOFF TAYLOR & ZAFMAN
SEVENTH FLOOR
12400 WILSHIRE BOULEVARD
LOS ANGELES CA 90025

WARREN, M	PART UNIT	PAPER NUMBER
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2815 DATE MAILED:

08/13/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trad marks

Office Action Summary

Application No.

09/109,261

Applicant(s)

Bai

Examiner

Matthew E. Warren

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 May 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 8-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- ☐ Interview Summary (PTO-413) Paper No(s) _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

This Office Action is in response to the Remarks filed on May 30, 2001.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 8-13, and 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 5,963,810) in view of Nagata et al. (US 4,015,281) and Momose et al. (US 5,990,516).

Gardner shows (fig. 3D) a semiconductor device having a multi-layered gate dielectric formed directly on the substrate. The first dielectric layer (303) of the gate dielectric is formed on the substrate. The first dielectric layer is silicon nitride (col. 5, lines 25-44). The second dielectric layer of the gate dielectric is a high dielectric constant material (305) of BST (col. 3, lines 15-43) and is formed on the first dielectric layer. The dielectric constant of the first dielectric layer (SiN) is less than the dielectric constant of the second dielectric layer (BST). A gate electrode (307a) is formed on the multi-layered gate dielectric. Gardner shows all of the elements of the claims except the for the formula to determine the dielectric constant and the thickness of the dielectric being less than 1/3 the gate length. Nagata discloses in column 4, starting at line 40, an expanded formula to determine the dielectric constant. Momose et al. discloses

(col. 2, lines 52-58) a semiconductor device in which the gate dielectric is less than $1/3$ the gate length. The thin gate dielectric improves hot carrier reliability and ultimately the operating characteristics. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the gate dielectric of Gardner by using the formula disclosed by Nagata to determine the appropriate thickness of a bi-layered gate dielectric. It would have been obvious to also modify the gate dielectric of Gardner by providing the dielectric with a thickness in relation to the gate length. Momose teaches that determining the thickness of the gate dielectric with respect to the gate length helps improve operational characteristics.

Claims 14 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 5,963,810) in view of Nagata et al. (US 4,015,281) and Momose et al. (US 5,990,516) as applied to claims 8 and 15 above, and further in view of Sato (US 5,258,645).

Gardner shows all of the elements of the claims except the third dielectric layer having a third dielectric constant. Sato discloses (col. 6, lines 49-58) a semiconductor device having a third insulating layer (12) formed as part of a tri-layered gate dielectric (17). The third layer (12) is silicon oxide and has a different dielectric constant than SiN and BST. The three-layer gate dielectric is formed to optimize the threshold voltage of the device and ultimately improve device characteristics (col. 4, lines 17-21). Therefore it would have been obvious to one of ordinary skill in the art to modify the bi-layer gate dielectric of Gardner by adding a third layer of dielectric material because Sata teaches

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that a triple layered gate dielectric optimizes the threshold voltage of a semiconductor and ultimately improves the device characteristics.

Response to Arguments

Applicant's arguments filed in the Remarks dated May 30, 2001 have been fully considered but they are not persuasive. The applicant primarily argues that the cited art does not disclose all of the elements of the claims, particularly that the thickness of the gate dielectric is less than $1/3$ of the gate length. As stated in the above rejection, Momose et al. cures the deficiencies of Gardner et al. in that Momose discloses a gate dielectric layer having a thickness less than $1/3$ the gate length (col. 2, lines 52-58). The gate length is 0.3 micrometers (300nm) and the insulating film thickness is less than 2.5 nm. One third of the gate length is 100nm and obviously, the insulating thickness of 2.5 nm is less than $1/3$ the gate length. Again, as stated in the rejection, Momose discloses in the cited paragraph that a device having such a characteristic has improved hot carrier properties. One of ordinary skill in the art would be motivated to improve the hot carrier properties of Gardner by making the equivalent thickness of the bilayered gate dielectric less than $1/3$ of the gate length, as taught by Momose. The examiner has shown all of the elements of the claims and motivation for combining the references, therefore the rejection is still proper and the Office Action is made final.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Warren whose telephone number is (703) 305-0760. The examiner can normally be reached on Mon-Thurs, and alternating Fri, 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 308-7722 for After Final communications.

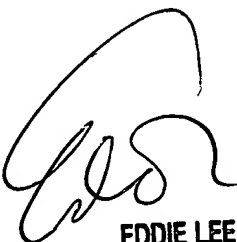
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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

MEW

MEW

August 9, 2001


EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800